

Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2020-102
Project Title:	Lightweight multifunctional noise barriers/noise enclosures incorporating smart fibre-reinforced polymer (FRP) composites
Principal Investigator:	Professor Yu Tao, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University
Total Approved Grant:	\$1,100,000
Duration:	1/7/2021 to 30/9/2023
Project Status/Remarks:	Completed
Project Scope:	<p>Traffic noise is one of the major environmental problems in Hong Kong. As a noise mitigation measure, noise barriers/enclosures have been widely used. However, the current traffic noise barriers/enclosures in Hong Kong typically involve the use of a heavy steel frame which largely limits the possibilities of varying the barrier form for aesthetic and structural benefits.</p> <p>This project aims to develop a novel noise barrier/enclosure system enabled by FRP composites. Comprising fibres embedded in a polymeric matrix, FRP can be made into a variety of shapes which allow the form of noise barriers/enclosures to be designed to suit the architectural needs. The excellent corrosion resistance of FRP leads to low maintenance costs, while its high strength-to-weight ratio translates into a light structural frame which facilitates the construction process. FRP sandwiched panels with excellent sound and energy absorption capacities may be used at the bottom of the system to provide additional protection against vehicle impact. Furthermore, fibre-optic sensors may be embedded into FRP for monitoring of the structural performance. The success of this project will offer a lightweight, durable, aesthetic and economical solution for retrofitting noise barriers/enclosures on existing road structures.</p>
Summary of the Findings/Outcomes:	<p>Traffic noise is one of the major environmental problems in Hong Kong. However, the current traffic noise barriers/enclosures in Hong Kong typically involve the use of a heavy steel frame which largely limits the possibilities of varying the barrier form for aesthetic and structural benefits. This project has investigated the development of a novel noise barrier/enclosure system incorporating fiber-reinforced polymer (FRP) composites. The novel system contains a structural frame made of pultruded FRP profiles and may be provided with FRP sandwiched panels with excellent sound and energy absorption capacities as well as fiber-optic sensors for monitoring of the structural performance; the system has many advantages including its lightweight nature, excellent corrosion resistance and structural performance, as well as the flexibility in its form to suit architectural needs. Combined experimental and theoretical studies have been conducted on the structural behaviours and acoustical performance of the novel noise barrier-enclosure system, leading to a design guideline for the system.</p> <p>The outcomes of this project offer a lightweight, durable, aesthetic and</p>

	economical solution for retrofitting noise barriers/enclosures on existing road structures as a noise mitigation measure.
--	---